CIRCULAR NO. 19. (DAIRY, NO. 16.)

United States Department of Agriculture.

BUREAU OF ANIMAL INDUSTRY.

FACTORY CHEESE AND HOW IT IS MADE.[1]

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MODERN METHODS PRACTICED IN THE UNITED STATES.

The successful cheese maker considers good milk of paramount importance. For this he must depend upon the producers and his own watchfulness.

Handling milk.—The first step in the process of making cheese—the care and handling of the milk—devolves upon the farmer. If up to date, he must have a good herd of cows, treat them kindly, and provide them with plenty of clean, wholesome food and pure water. As the quality of milk depends much upon the management of the cow, pure milk may be expected from a well-cared-for dairy. After the milking is completed, the milk should be immediately taken from the stable and well aerated, or brought in contact with the air, either by running thinly over a flat or fluted surface or passing from one vessel to another in fine streams or thin sheets. Milk should be aerated in a place where the air is fresh and pure, being free from stable or other objectionable odors. As the object is to remove the so-called animal odors from the milk, it would be useless to perform the work in an atmosphere laden with the same or worse smells than it is desired to expel. When delivery to the factory is but once a day, the night's milk, after being aerated, is cooled to 70 degrees F. or less; this is necessary to insure the keeping quality of the milk and its arrival at the factory in good condition.

All cans, pails, strainers, and whatever utensils come in contact with the milk must be thoroughly washed with the aid of some cleanser, such as soap or salt, rinsed with boiling water or exposed to live steam, and placed where they will be thoroughly aired. By this means they are kept sweet and free from taint.

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[1] Reprinted from Bulletin No. 15, Bureau of Animal Industry (Dairy, No. 6).

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The milk is all delivered at the factory in the morning between the hours of 5 and 8 o'clock. The night and the morning milk should be brought separately, although they are sometimes mixed where the quantity supplied by a patron is small. The cheese maker knows it is his duty to receive no milk unless in proper condition. He stands at the receiving window and by the use of his eyes and nose is able to detect any impure milk; all such must be absolutely rejected. He must have the experience and force of character to impartially perform this duty. Upon the milk being accepted, it is poured into the receiving can and a small sample is taken at this time for the fat test to be made later.

Sampling milk.—For sampling, a deep cylindrical cup holding about 1 ounce is used. This sample of milk is poured into a bottle large enough to hold 12 or 14 of such samples and bearing the number of the patron whose delivery of milk is sampled. One such bottle, or jar, is provided for every patron. A sample of each patron's milk is put into the proper bottle every day for ten days or more, and from this composite sample, as it is called, the test is made by the Babcock method of the fat contained in this patron's milk. A small amount of corrosive sublimate,[1]—about as much as can be taken on the point of a common penknife—is put into the bottle previous to saving the first sample; this prevents the milk from souring and preserves it in a suitable condition for testing. After sampling, the milk is weighed and the patron credited with the number of pounds of milk he delivers. The milk is then run from the receiving can through a tin conductor into the storage vats. Each vat ordinarily holds about 5,000 pounds of milk.

Heating milk.—The temperature of the milk is then raised, heat being applied as follows: Between the wooden part of the vat and the tin lining there is an open space, which is filled with water; the water is heated by steam introduced through perforated pipes running in this space along the whole length of the vat. The warm water thus surrounding the tin lining of the vat gradually raises the temperature of the milk. The heating should begin while the vat is filling or as soon as filled, and should not be done too fast. After the required temperature of 82 degrees F. to 86 degrees F. is reached, the heating is stopped. The heating of the first vat usually begins at 6 o'clock or soon after, and all milk should arrive so the heating of the last lot may begin not later than 8 o'clock.

Determining ripeness.—The next step is to ascertain if the milk is in a condition ripe enough to add the rennet. Perhaps the most satisfactory method to determine the ripeness of the milk is the rennet test. The following specially prepared apparatus is necessary: An enameled cup, graduated on the inside, with a fine hole in the bottom, a pipette of 1 cubic centimeter, and a small bottle marked on the neck. With the pipette 1 cubic centimeter of rennet extract is measured into this bottle, which is then filled with water to the mark on the neck. Rinsing the pipette into the bottle is important. If the extract used be of standard strength, this will give a uniform solution at all times. The cup is then filled with milk and set on the edge of the vat. When enough milk has run from the cup to bring

[1]Other substances, among them bichromate of potash and formaldehyde, having a similar effect, are also used as preservatives.

the surface of the milk down to the zero, or first mark on the inside, the diluted rennet is quickly added, the whole stirred well, and the cup left undisturbed. The milk in the cup is closely watched, and as soon as coagulation takes place it will stop running through the fine hole in the bottom of the cup. The graduation on the inside of the cup will show the amount of milk which has run out, and from this the maker knows the degree of ripeness which the milk has attained. This little operation requires some skill and experience.[1] The temperature of the milk and the strength of the rennet being always uniform, the variation in the amount of milk running from the cup before coagulation takes place will depend solely upon the degree of acidity of the milk.

When the milk is very sweet the ripening process is hastened by using a small quantity of clean sour milk, free from any taint. If this milk is thick, it is strained through a cloth so there will be no little lumps of loppered milk put into the vat. The milk should be so ripened that it will take from three and one-half to four hours from the time the rennet is added until the curd is ready to press. The degree of ripeness necessary to accomplish this result is only to be determined by experiment on the part of the maker. The condition of milk and degree of ripeness necessary will vary somewhat in different factories, and the cheese maker has to use his judgment at such times. When cheese is to be colored the coloring extract is put into the milk in the vat and well mixed in at least ten minutes before adding the rennet.

Handling the curd.—When, in the judgment of the maker, the milk is ready to proceed, sufficient rennet is added to coagulate the mass in about 30 minutes. The curd being set, it is ready to cut when it will break clean over the finger. For cutting the curd two forms of gang knives are used, a horizontal and a perpendicular knife, with blades about one-third to one-half inch apart. The curd is cut lengthwise and crosswise of the vat with each knife. This amount of cutting leaves the curd in cubes of about one-third of an inch on a side. The degree of fineness into which the curd must be cut depends on the ripeness of the milk, and is a matter which must be determined by the manner in which the moisture is expelled from the curd before the whey is drawn. It is usually about an hour and a half from the time heat is applied to the vat until the curd is cut. After cutting, the curd is gently agitated, to prevent it from settling to the bottom of the vat and matting together. The stirring allows the curd to shrink and expel the whey, or a portion of it. The kernel, or small cube or lump, of curd forms a thin skin or film over its surface, which prevents the fat globules and other cheese constituents from working out into the whey. The stirring of the curd after it is cut may be done by a hand tool called the curd rake. But a better factory appliance for this purpose is the "automatic curd agitator," which is attached to the vat and operated by steam. There are at least three different patterns of these agitators which do the work more satisfactorily than the hand rake. After stirring the curd for about ten minutes, heat is applied again to the vat through its water jacket, slowly at first; for if heated too fast the

[1]This is known as the Marschall test, the simple apparatus being sold by dairy-supply houses.

pieces of curd would cook on the outside and thus hold in the whey. After a temperature of about 92 degrees F. is secured the curd is heated faster until the required temperature of 97 degrees to 100 degrees F. is reached. This process, which is often called "cooking the curd," usually takes about one hour's time. During the heating process the curd is continually stirred and not allowed to get lumpy or to mat in the least. All the kernels must be kept separate to insure an even cooking. After the required temperature is reached the curd is still agitated for a few moments. The vat is then covered to assist in holding the curd at an even temperature until ready to draw the whey. If the heat drops it is again raised to the original temperature. It is important to know when the curd is cooked enough. This the cheese maker determines by taking a double handful and pressing it together in his hands. If on removing one hand the curd readily falls apart it is cooked enough; otherwise it will be soft and hang together in a ball. When the curd will string about one-fourth to one-third of an inch on a hot iron the whey is drawn. The time occupied from the beginning of the cooking until the whey is drawn varies from two to four hours, averaging two and one-half to three hours.

In using the hot-iron test a small amount of curd is compressed in the hand until dry. This, when touched to a hot iron and slowly drawn away, will leave fine silky threads sticking to the iron if any acid has developed. The amount of acid is determined by the length of these strings. Any piece of bright, clean iron one-half inch in diameter and about 18 inches long will answer for this purpose.

After drawing the whey the curd is stirred somewhat and thrown up on each side of the vat. The vat is lowered at one end to make an incline to allow the whey to drain away from the curd. As the whey passes off and the curd becomes dry it becomes matted together and is then cut in pieces about 6 inches square and piled one on top of the other in one end of the vat. The curd is now turned as often as once in ten or fifteen minutes and piled in larger piles as fast as it will allow. Always keep in mind the fact that the surplus moisture must be expelled if we wish to make a good-keeping cheese. If curd is in a good condition it is kept warm by covering with a cloth and repiled occasionally. The curd soon becomes firm, and when a piece is taken in the hand it will feel velvety and pull apart in flakes. At this stage the curd will pull from three-fourths to 1½ inches on the hot iron. The curd is now ground and salted. Use from 2 to 2¾ pounds of salt to 1,000 pounds of milk. The salt is well stirred in and curd allowed to lie in the vat, with an occasional stirring, until salt is all dissolved and curd feels smooth and silky; it is then ready to press. The average time occupied from drawing the whey to this point is two hours, and from first heating the milk to the beginning of pressing the time is from five to six hours.

There are several kinds of mills for grinding curd. The one most commonly used consists of two cylinders covered with teeth and revolving toward each other, which pick the curd to pieces. The mill fits across the vat and the curd is ground through it into the vat.

The curd when ready for pressing is dipped from the vat with a flat-sided curd pail and put in the hoops, an equal amount being measured into each hoop. The hoops are immediately placed in the press and pressure applied.

There are several kinds of hoops, the most common sizes being the 14½ by 10 inch and the 13½ by 6 inch—that is, the hoops press cheese of those sizes. The bandage is put on an iron rim called a bandager, which slips into the top of the hoop and holds the bandage in place, with the lower edge of the bandage turned in for about an inch on the bottom of the hoop, a cap cloth being first put in the bottom of the hoop.

There are times during the season, usually in the summer months, when curds have a tendency to be mushy, and will not become firm if piled. These curds are handled differently, being left in the whey longer—in fact as long as the maker deems it safe. The whey is then drawn and curd stirred thoroughly until it feels dry. It is then spread out over the vat, kept cool, and handled often in order to expel the moisture. When the curd becomes firm it is ground and salted, the salt thoroughly stirred in and the curd put in hoops and pressed at once. The curds if allowed to get mushy will make what is known as an oily cheese. The cause of this is found to be due mainly to a lack of the proper proportion of casein in the milk.

Pressing and curing.—The pressing of the cheese is done lightly at first, and afterwards the pressure is gradually increased. After pressing about an hour the cheese is taken out and turned over in the hoops, the bandage carefully turned down and cap cloth put on smoothly. Stronger pressure is then applied and oftener until the press is reached. The cheeses are kept under the pressure for sixteen or eighteen hours, when they are taken out of the hoops and placed in the curing room. The cap cloths are left on the cheeses until they are ready for market.

The curing room is built with a wind-proof wall to guard against sudden changes in temperature, and provided with tight windows and blinds. The room is keep as nearly as possible at a temperature of 55 to 70 degrees F., and should be well ventilated, so that the cheese may cure properly and have a clean flavor. The room should have tables, upon which the cheeses are turned and wiped. The cheeses, after being placed in the curing room, are turned over every morning and kept clean and free from mold and dirt; the tables are also wiped clean. Use some canvas cloth for this purpose. The curing room is darkened during the day to keep it free from flies; in warm weather the windows and blinds are closed in the daytime to exclude the heat, and thrown open at night to cool the room. The cheeses remain in the curing room on an average of three to four weeks. The conditions governing this variation in length of time are due to the differences in the manufacture of the cheese, temperature of curing room, and the state of the cheese market.

When ready for market, the cap cloths are removed from the cheeses and they are boxed; a scale board is placed in the bottom of each box and one on top of each cheese put in the box. The boxes are evenly trimmed to within one-eighth to one-fourth of an inch of the top of the cheese and the cover put on. The official State brand is put on the top of both the cheese and the box, and the manufacturer's or factory brand is also usually put on the box.

The foregoing is a description of the latest improved methods practiced in factories in the State of New York, where cheese of the usual 60-pound Cheddar form and style is made, principally for export.

Cheese for home trade is made in the same way, except that the whey is drawn off as soon as the curd shows any acid by the hot-iron test. The curds are well matured in the vat and salted with about 2 pounds of salt for every 1,000 pounds of milk.

METHOD OF APPORTIONING DIVIDENDS UPON THE FAT-TEST BASIS.

The custom as to time of settlement for milk supplied by patrons varies somewhat in different factories. In most cases computations are made and settlements reached every two weeks, although some use monthly periods. Each settlement is made for a definite period of manufacture, and after the cheese made in that period has been cured, shipped, sold, and paid for.

The basis of settlement is the amount of fat delivered. The quantity of milk which a patron brings in ten days, or the period of the composite test, is taken from the daily records. This is multiplied by the percentage of fat for the same period, as shown by the test. The result is the pounds of fat delivered, and the sum of these amounts for the different test periods of the month is the total amount of fat which the patron has brought. After the amount of fat delivered by each patron has been found, the total delivered by all patrons is easily obtained. From the gross receipts for cheese sold the expense of manufacturing is deducted and the net proceeds of sales are divided by the total number of pounds of fat delivered by all patrons; the quotient is the net amount for each pound of milk fat which has been realized by the sales of cheese. Each patron is to be paid at this rate for the number of pounds of fat contained in the milk furnished by him. For the purpose of showing the patrons how their tests compare with the average test of all milk received, the latter is given in the patrons' statements; it is obtained by dividing the total amount of fat by the total amount of milk delivered.[1]

For illustration, take the examples following, to cover a period of one month: A delivers during the first ten days of the month 1,500 pounds of milk testing 3.2 per cent of fat; during the next ten days 1,700 pounds testing 3 per cent, and during the last ten days 1,600 pounds testing 3.1 per cent. B delivers during the first ten days 2,500 pounds of milk testing 3.6 per cent; the next ten days 2,700 pounds testing 3.5 per cent, and the last ten days 2,800 pounds testing 3.7 per cent. C delivers 2,000 pounds testing 4 per cent the first ten days; 2,200 pounds testing 4.1 per cent the next ten days, and 2,400 pounds testing 4.2 per cent the last ten days. We find the total of milk delivered by all to be 19,400 pounds; total number of pounds of fat, 707.7. Supposing that from this milk 1,940 pounds of cheese was made, selling at 10 cents per pound, the following figures will be found upon the record books of the factory:

Gross receipts, 1,940 pounds of cheese, at 10 cents	$194.00
Deduct cost of making and furnishing cheese, at $1 per hundredweight	19.40
Net proceeds to be paid to patrons	174.60
$174.60 divided by 707.7, the total pounds of fat, gives the net price per pound of fat to patrons as	$0.24671+
Average per cent of fat in all milks	3.64+
Number of pounds of milk to 1 pound of cheese	10

[1] The wording of this paragraph, as originally published, has been slightly changed to make the meaning clearer.

Settlements with individual patrons:

	Milk.	Fat.		Payment or dividend.
A:	*Pounds.*	*Per cent.*	*Pounds.*	
First 10 days	1,500	3.2	48	
Next 10 days	1,700	3.0	51	
Last 10 days	1,600	3.1	49.60	
	4,800		148.60, at $0.24671	36.66
B:				
First 10 days	2,500	3.6	90	
Next 10 days	2,700	3.5	94.50	
Last 10 days	2,800	3.7	103.60	
	8,000		288.10, at .24671	71.08
C:				
First 10 days	2,000	4	80	
Next 10 days	2,200	4.1	90.20	
Last 10 days	2,400	4.2	100.80	
	6,600		271.00, at .24671	66.86
Total				174.60

A statement similar to the following is given monthly to every patron:

September dividend, 1895.

Mr. —— A——:

Number of pounds of milk received from your dairy during the above-named month, given in separate amounts, with per cent of fat in each, as shown by the Babcock test:
1,500 pounds, 3.2 per cent fat.
1,700 pounds, 3.0 per cent fat.
1,600 pounds, 3.1 per cent fat.

Total ..... Milk, 4,800 pounds; fat, 148.60 pounds.

Average per cent of fat in all milks delivered at the factory during said month ..... per cent .. 3.64+

Amount of milk required to make 1 pound of cured cheese during said month ..... pounds .. 10

Average price per pound received for the cheese made during said month $0.10

Net price per pound of fat $0.24671

Amount of cash now paid to you, being in full for the milk delivered by you during said month, after deducting my charge of $1 per 100 pounds for making the cheese and furnishing materials $36.66

By this statement the patron can see how much he has delivered during each period covered by the sales, and the testing, and the per cent of fat in his milk during that period. He can also compare the per cent of fat in his milk with the average of all milks delivered at the factory during the month.

In changing from the old method of paying for all milk alike by its weight, to the fat basis, the question was brought before our patrons at their regular annual meeting and thoroughly explained. The patrons had been informed some little time previous to the meeting of the intention of taking some action in the matter, and several of them had given thought and study to the new method and were prepared to discuss the question intelligently. After a thorough exchange of opinions a majority were in favor of adopting the new method.

During the first year of using the test the patrons made little objection to its use, preferring to give it a fair trial and note its effects. The conclusion reached by the patrons after this trial was clearly

shown at the next annual meeting, when, with but a single objection, it was voted to continue the test method. At the present writing, after three years' practical use of the Babcock test, the patrons would not consent to a return to the old method.

The introduction of the fat basis has resulted in a general improvement of the interests of our factory and the patrons. The quality of the milk being an important factor in determining its value has led to a more systematic method of breeding. Almost every dairyman and patron is giving more thought to the principles governing breeding and is endeavoring to produce a herd giving a large amount of milk of the best quality. He also feels more interested in his work and consequently his milk is better cared for and delivered at the factory in better condition. The cheese maker is thus enabled to produce a finer quality of cheese and also to show an increase in the amount of cheese manufactured from every 100 pounds of milk.

This basis of settlement is certainly far more equitable as well as better, because of the results stated, than the one so long in use and still adhered to by many factories. Canadian authorities now claim, however, that it is not quite fair to depend upon the fat content of the milk alone, but that the casein should also be taken into consideration. More time and experience is necessary to consider this proposition for a further change in the basis of settlement with patrons.

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